IS 12331 (1988): General Requirements for Canal Outlets
[WRD 13: Canals and Cross Drainage Works]

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IS : 12331 - 1988
(Reaffirmed - 2012)

Indian Standard

GENERAL REQUIREMENTS FOR CANAL OUTLETS

UDC 626·823·92

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

Gr 4

October 1988

AMENDMENT NO. 1 SEPTEMBER 2005
TO
IS 12331 : 1988 GENERAL REQUIREMENTS FOR CANAL OUTLETS

(*Page* 5, *clause* **5.1**) — Substitute the following for the existing.

'**5.1 Cement** — It shall conform to IS 269 1989†, or IS 1489 (Part 1) 1991‡, or IS 1489 (Part 2) 1991‡, or IS 8112 1989|||| or IS 12269 1987¶¶ as specified by the engineer-in-charge '

(*Page* 5, *clause* **5.2.1**) — Substitute the following for the existing subclause

5.2.1 *General Requirements* — The compressive strength and water absorption shall be in accordance with IS 1077 1992§, or IS 12894 2002***, or IS 13757 1993††† '

(*Page* 5, *clause* **5.5**) — Substitute IS 456 2000†† *for* 'IS 456 1978††'

(*Page* 5, *footnotes*) — Substitute the following footnotes marked '†',' ††', '‡' and '§' for the existing

'† Specification for 33 grade ordinary Portland cement (*fourth revision*)

†† Plain and reinforced concrete — Code of practice (*fourth revision*)

‡ Specification for Portland pozzolana cement Part 1 Flyash based (*third revision*), and Part 2 Calcined clay based (*third revision*).

§ Common burnt clay building bricks — Specification (*fifth revision*) '

(*Page* 5, *footnotes*) — Add the following at the end

|||| Specification for 43 grade ordinary Portland cement (*first revision*)

¶¶ Specification for 53 grade ordinary Portland cement

*** Pulverized fuel ash — Lime bricks — Specification (*first revision*)

††† Specification for burnt clay flyash building bricks '

(WRD 13)

Reprography Unit, BIS, New Delhi, India

Indian Standard

GENERAL REQUIREMENTS FOR CANAL OUTLETS

0. FOREWORD

0.1 This Indian Standard was adopted by the Bureau of Indian Standards on 30 March 1988, after the draft finalized by the Irrigation Canals and Canal Linings Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 An outlet connects the water course with the distribution channel and may provide a measure of discharge passing through it. It is a device built at the head of a water course to control the flow of water in it.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the general requirements for outlets installed on irrigation channels after selection of the type of outlet in accordance with IS : 7986-1976*.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 7986-1976* shall apply.

3. GENERAL REQUIREMENTS FOR OUTLETS

3.1 An outlet shall be structurally strong and shall not have moving parts liable to derangements or requiring periodic attention.

3.2 Interference by the cultivator shall be difficult and, if made, shall be readily detectable.

3.3 The outlet shall draw its fair share of silt carried by parent channel.

3.4 It may be possible for the outlet to work efficiently with a small working head. Larger the working head, higher the water level required in the parent channel and the cost of distribution system.

3.5 The outlet shall be economical.

4. TYPES OF OUTLETS

4.1 Modular Outlets — Modular outlets are the outlets whose discharge is independent of the water levels in the distributing channel and the water course within reasonable working limits. This type of outlets are either with moving parts or without moving parts. In the latter case, these are called as rigid modules.

Modular outlets with moving parts are not simple to design and construct, and are thus expensive. These are liable to derangements due to increase in friction, rusting of the moving parts and any obstruction in the working of moving parts caused by the silt and weeds carried in flowing water.

4.2 Non-Modular Outlets

4.2.1 *Pipe Outlets* — It consists of rectangular or circular openings and pavements. A typical layout of this class of outlet is shown in Fig. 1. A pipe outlet with one end submerged in water course is called non-modular and its discharge is calculated by the formula :

$$q = CA\sqrt{2gH}$$

where

g = acceleration due to gravity;

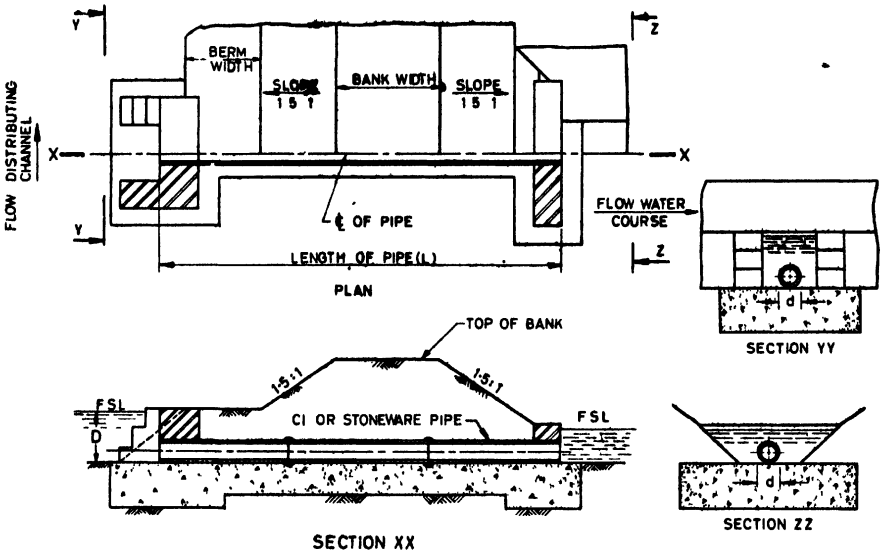
A = cross-sectional area of pipe in cm²;

C = co-efficient of discharge which depends on friction factor, length and size of the outlet

$$= \frac{1}{2 \times 10^5}\sqrt{\frac{d}{f\left(L + \frac{1{\cdot}5\,d}{400\,f}\right)}};$$

H = difference of water levels in distributing channel and water course in metres;

*Code of practice for canal outlets.



Note — Where necessary suitable pitching may be provided at the down-stream of the pipe outlet.

FIG. 1 PIPE OUTLET

f = co-efficient of fluid friction for pipes. Its values would be 0·005 and 0·01 for clear and encrusted iron pipes respectively. For earthenware pipes, its value may be taken as 0·007 5;

L = length of pipe in metres;

d = diameter of pipe in cm; and

q = discharge in m^3/sec of an outlet.

The values of C shall be in accordance with IS : 7986-1976*.

The pipes are fixed horizontally at right angles to flow and are laid on light concrete foundation to prevent uneven settlement and consequent leakage.

4.3 Semi-Modular Outlets

4.3.1 *Pipe Outlets* — This type of outlet is independent of water level in the water course so long as minimum working head required is available. Non-modular outlet works as semi-modular if the exit end of the pipe is made to discharge water with a free fall into a cistern of 0·6 to 0·9 m at the start of water course. In this case, working head H, is the difference between water level in distributing channel and the centre of pipe outlet.

4.3.2 *Open Flume Outlet* — The open flume outlet is a smooth weir with a throat constructed sufficiently to ensure velocity above the critical, and long enough to ensure that the controlling section remain within the parallel throat at all discharges up to the maximum. A gradually expanding flume is provided at the outfall to obtain the maximum recovery of head. The entire work is built in brick masonry but the controlling section is generally provided with cast iron or steel bed and check plates (*see* Fig. 2 and Fig. 3).

The discharge is calculated by the formula:

$$q = K B_t H^{3/2}$$

where

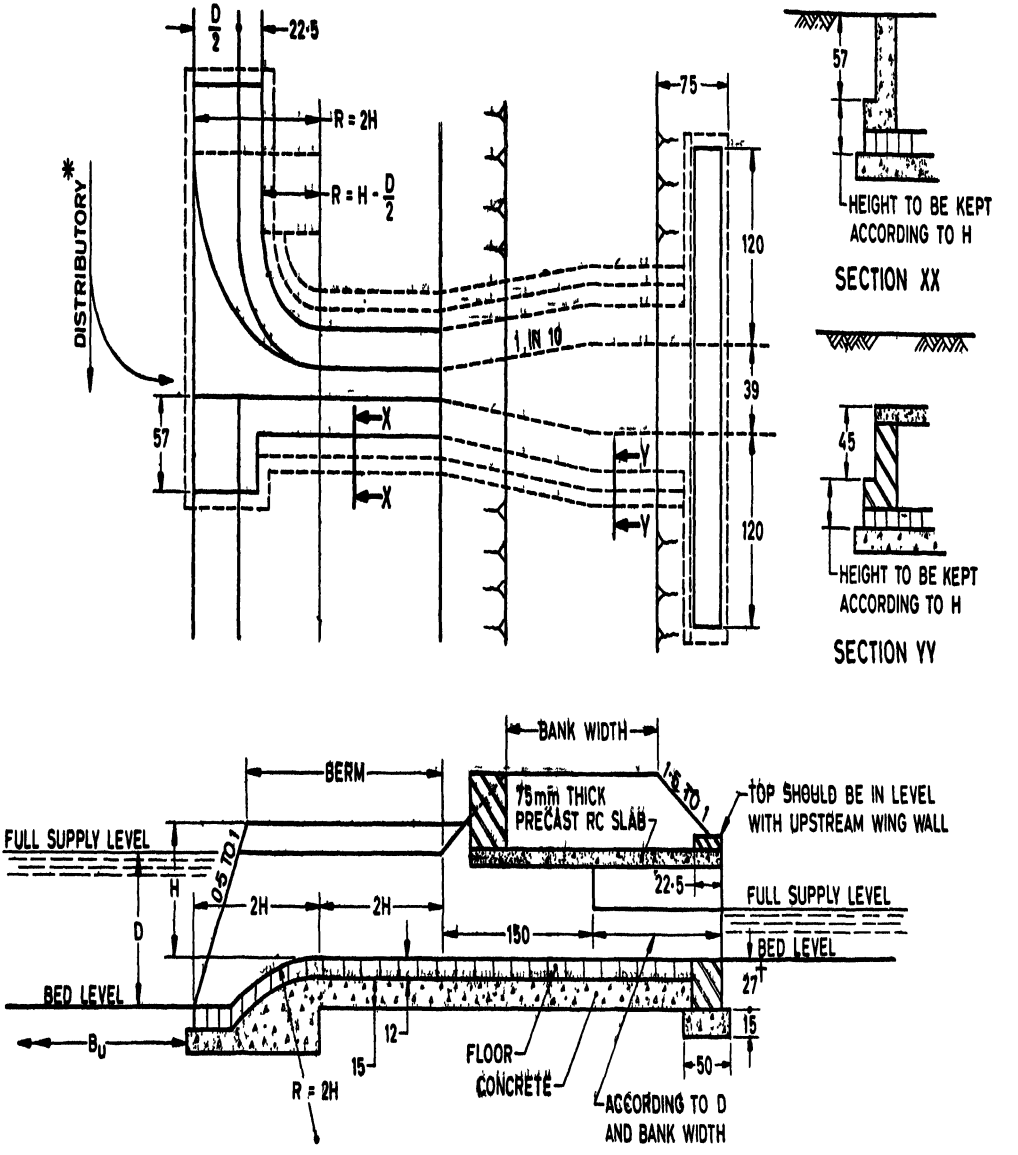
K = constant depending upon the width of the flume,

B_t = width of throat of weir in an outlet, and

H = head over crest in metres.

So long as a steady standing wave forms, the discharge through the outlet is independent of water level in the water course. For B_t above

*Code of practice for canal outlets.

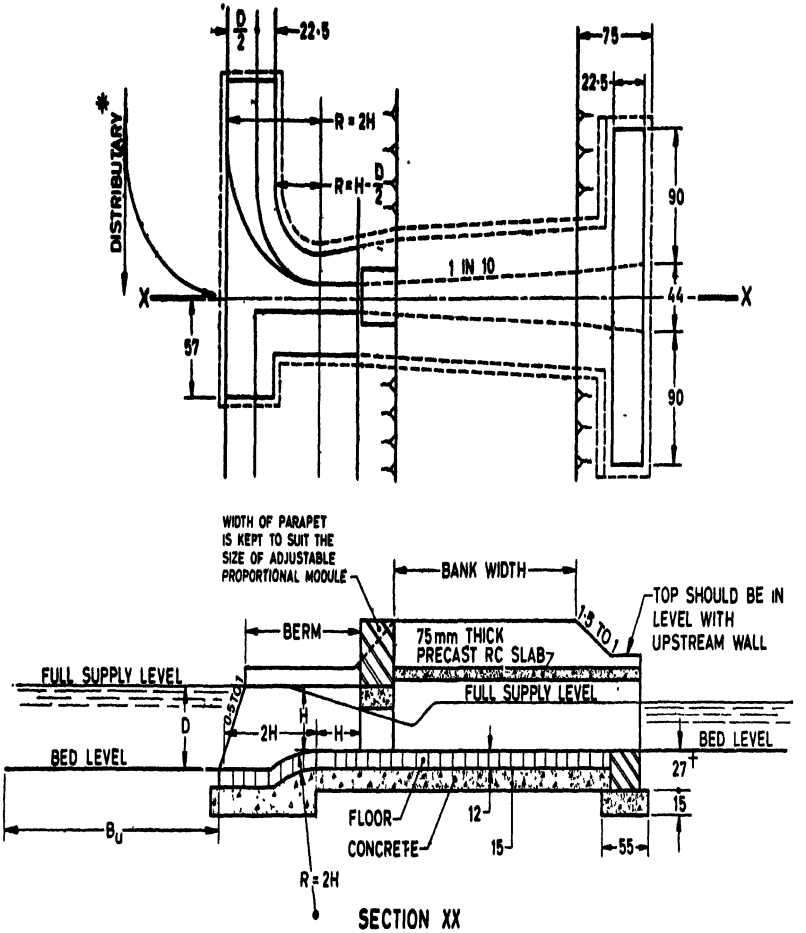


*Where bed width of channel is reduced below outlet downstream wing wall should be at downstream toe of slope and upstream wing at upstream toe of slope

†Where bed of water course is lower than floor of outlet downstream curtain and wing walls to be taken down 30 cm below bed of water course and if necessary a cistern to be provided

All dimensions in centimetres

FIG. 2 TYPE PLAN OF OPEN FLUME OUTLET FOR DISTRIBUTARY ABOVE 0·6 m DEPTH AND *H* IS LESS THAN FULL SUPPLY DEPTH



*Where bed width of distributory reduced below outlet downstream wingwall should be at downstream toe of slope and upstream wing at upstream toe of slope.

†Where bed of water course is lower than floor of outlet downstream curtain and wing walls to be taken down 30 cm below bed of water course and if necessary a cistern to be provided.

All dimensions in centimetres.

FIG. 3 TYPE PLAN OF OPEN FLUME OUTLET WITH ROOF BLOCK

6 cm and up to 9 cm, $K = 1{\cdot}6$. For B_t above 9 cm and up to 12 cm, $K = 1{\cdot}64$. For B_t more than 12 cm, $K = 1{\cdot}66$. In practice, B_t is never kept less than 6 cm, as such it becomes necessary to raise the crest of the outlet much above the bed level. Working head required in an open flume outlet with a 1 in 5 glacis and side walls splaying at 1 in 5 is 20 percent of the depth of water above the crest of outlet.

NOTE — This type of outlet is most suited to tail clusters and proportional distributors.

4.3.3 *Crump's Adjustable Proportional Module (Crump's APM)* — This type is most commonly used outlet under this class. In this type of outlet, CI base, CI roof block and check plates on either side form the nucleus around which masonry is built. The roof block is fixed to check plates by bolts which may be removed and the depth of outlet adjusted after the masonry is dismentled. This type of outlet cannot easily be tempered with and at the same time may be conveniently adjusted at a very small cost. Typical layout is shown in Fig. 4.

The setting of the wing wall can be calculated by the following formula :

$$W = K \frac{q}{Q}(B_u + D/2)$$

where

W = setting forward of the d/s wing wall of the approach,

K = ratio between the mean velocity for the entire distributing channel and the mean velocity in the part of the distributing channel where an outlet is to be installed,

q = discharge in m³/sec of an outlet,

Q = discharge in m³/sec of distributory channel upstream of the outlet,

B_u = bed width of distributory channel upstream of the outlet, and

D = depth of water in distributing channel.

Q (m³/sec)	K
Below 0·283	1·00
Over 0·283 up to 1·415	1·25
Over 1·415 up to 5·660	1·50
Over 5·660	2·00

4.3.3.1 The discharge in this type of outlet shall be calculated in accordance with IS : 7986-1976*.

5. MATERIAL

5.1 Cement — It shall conform to IS : 269-1976† or IS : 1489-1976‡.

5.2 Bricks — Bricks shall measure 190 × 90 × 90 mm or 190 × 90 × 40 mm with tolerance per 20 bricks as given below :

a) Length : 372 to 388 cm (380 ± 8 cm),

b) Width : 176 to 184 cm (180 ± 4 cm),

c) Height : 176 to 184 cm (180 ± 4 cm) for 90 mm high bricks, and 76 to 84 cm (80 ± 4 cm) for 40 mm high bricks.

5.2.1 *General Requirements* — The compressive strength and water absorption shall be in accordance with IS : 1077-1986§.

5.3 Sand for Mortar — The sand shall consist of natural sand, crushed stone or crushed gravel sand or a combination of any of these. The sand shall be hard, durable, clean and free from adherent coatings and organic matter, and shall not contain the amount of clay, silt and fine dust more than the specified in IS : 2116-1980‖.

5.3.1 *Grading of Sand* — Grading of sand shall be in accordance with IS : 2116-1980‖ and IS : 1542-1977¶.

5.4 Aggregates for Concrete — Fine and coarse aggregates for plain and reinforced concrete shall be in accordance with IS : 383-1970**.

5.5 Concrete — Plain and reinforced concrete shall be in accordance with IS : 456-1978††.

5.6 Water — Water fit for drinking is acceptable for making concrete or mortar. Mortar shall be free from algae, industrial or domestic waste. About 2 000 ppm of suspended clay or rock particles are permissible in mixing water. The permissible values shall be in accordance with IS : 3860-1966‡‡.

5.7 Cast Iron Blocks — All the castings shall conform to IS : 210-1978§§.

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*Code of practice for canal outlets.

†Specification for ordinary and low heat Portland cement (*third revision*).

‡Specification for Portland-pozzolana cement (*second revision*).

§Specification for common burnt clay building bricks (*fourth revision*).

‖Specification for sand for masonry mortars (*first revision*).

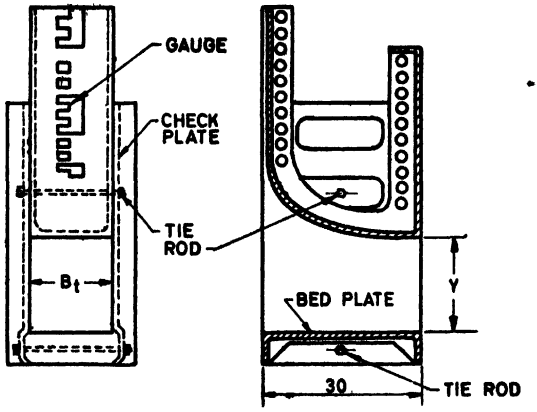
¶Specification for sand for plaster (*first revision*).

**Specification for coarse and fine aggregates from natural sources for concrete (*second revision*).

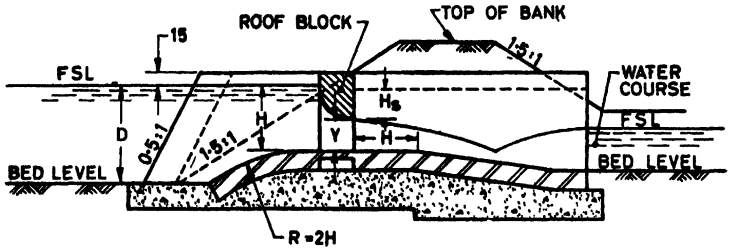
††Code of practice for plain and reinforced concrete (*third revision*).

‡‡Specification for grey iron castings (*third revision*).

§§Specification for precast cement concrete slabs for canal linings.



DETAILS OF ROOF BLOCK



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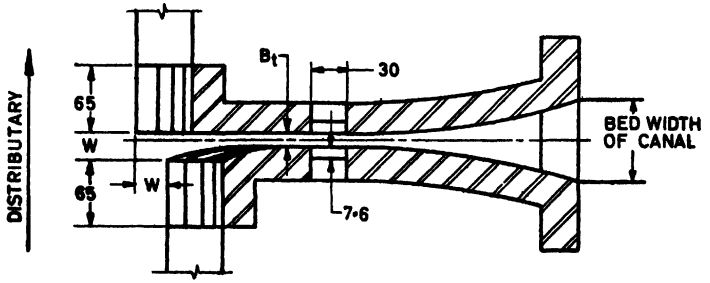

PLAN

All dimensions in millimeters.

FIG. 4 CRUMP'S ADJUSTABLE PROPORTIONAL MODULE

5.8 Earth Work

a) *For Non-Compaction Zone* — Earth work shall be free from shrubs, clods and properly laid in layers of 15 cm and dressed properly.

b) *Earth Work in Compaction Zone* — Earth work in the compaction zone and under bed, wherever required, would be laid in 7·5 cm layers and compacted with drumuts or other mechanical compactors at optimum moisture content.

c) Dry bulk density and optimum moisture content shall be in accordance with the checked field requirements.

5.8.1 After the completion of structure, there shall be no leakage. Puddling of earth work may also be done wherever necessary behind the walls of outlet where refilling of earth work is to be done to check leakage or seepage of water (*see* IS : 4701-1982*).

5.9 Precast RCC Slab — It shall be laid in accordance with IS : 3860-1966† IS : 456-1978‡, IS : 432 (Part 1)-1982§ and IS : 2502-1963‖.

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*Code of practice for earthwork on canals (*first revision*).

†Specification for precast cement concrete stabs for canal linings.

‡Code of practice for plain and reinforced concrete (*third revision*).

§Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement: Part 1 Mild steel and medium tensile steel bars (*third revision*).

‖Code of practice for bending and fixing of bars for concrete reinforcement.

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